

Dell PowerEdge M I/O  
Aggregator  
**Getting Started Guide**

**Regulatory Model: PEMIOAggregatr**



# Notes, Cautions, and Warnings



**NOTE:** A NOTE indicates important information that helps you make better use of your computer.



**CAUTION:** A CAUTION indicates potential damage to hardware or loss of data if instructions are not followed.



**WARNING:** A WARNING indicates a potential for property damage, personal injury, or death.

---

**Information in this publication is subject to change without notice.**

**© 2012 Dell Inc. All rights reserved.**

Reproduction of these materials in any manner whatsoever without the written permission of Dell Inc. is strictly forbidden.

Trademarks used in this text: Dell™, the DELL logo, Dell Precision™, OptiPlex™, Latitude™, PowerEdge™, PowerVault™, PowerConnect™, OpenManage™, EqualLogic™, KACE™, FlexAddress™ and Vostro™ are trademarks of Dell Inc. Intel®, Pentium®, Xeon®, Core™ and Celeron® are registered trademarks of Intel Corporation in the U.S. and other countries. AMD® is a registered trademark and AMD Opteron™, AMD Phenom™, and AMD Sempron™ are trademarks of Advanced Micro Devices, Inc. Microsoft®, Windows®, Windows Server®, MS-DOS® and Windows Vista® are either trademarks or registered trademarks of Microsoft Corporation in the United States and/or other countries. Red Hat Enterprise Linux® and Enterprise Linux® are registered trademarks of Red Hat, Inc. in the United States and/or other countries. Novell® is a registered trademark and SUSE™ is a trademark of Novell Inc. in the United States and other countries. Oracle® is a registered trademark of Oracle Corporation and/or its affiliates. Citrix®, Xen®, XenServer® and XenMotion® are either registered trademarks or trademarks of Citrix Systems, Inc. in the United States and/or other countries. VMware®, Virtual SMP®, vMotion®, vCenter®, and vSphere® are registered trademarks or trademarks of VMware, Inc. in the United States or other countries.

Other trademarks and trade names may be used in this publication to refer to either the entities claiming the marks and names or their products. Dell Inc. disclaims any proprietary interest in trademarks and trade names other than its own.

**Regulatory Model PEMIOAggratr**

**August 2012 P/N KGCK9 Rev. A00**

# Contents

- 1 Introduction . . . . . 7
- 2 Product Description . . . . . 7
- 3 Hardware Overview . . . . . 8
  - Internal Ports . . . . . 8**
  - Front Panel . . . . . 8**
  - Base Module with 40GbE Ports . . . . . 8**
  - FlexIO™ Modules with Uplink Ports . . . . . 9**
  - Port Numbering . . . . . 11**
  - USB Console Port . . . . . 12**
  - System and Port LEDs . . . . . 13**
  - Installation . . . . . 15**
    - Site Preparation . . . . . 15
  - Unpacking the Aggregator . . . . . 16**
    - Package Contents . . . . . 16
    - Unpacking Steps . . . . . 16

## 4 Installing and Configuring the Aggregator 16

<b>Installing the Aggregator in a PowerEdge Chassis . . .</b>	<b>18</b>
<b>Connecting a Console Terminal . . . . .</b>	<b>20</b>
<b>Invoking the X-Loader and U-Boot CLIs . . . . .</b>	<b>21</b>
<b>Reconfiguring Default Settings . . . . .</b>	<b>21</b>
Before You Start . . . . .	22
Reconfiguration Using the CMC Interface . . . . .	22
Reconfiguration Using the CLI . . . . .	22
<b>Aggregator Auto-Configuration . . . . .</b>	<b>25</b>
DCB Support . . . . .	26
FCoE Connectivity. . . . .	26
iSCSI Operation . . . . .	26
Link Aggregation . . . . .	27
Link Tracking . . . . .	27
<b>Configuring VLANs . . . . .</b>	<b>27</b>
Uplink LAG . . . . .	28
Server-Facing LAGs. . . . .	28
Stacking Mode . . . . .	28

## 5 Assembling a Switch Stack . . . . . 29

<b>Cabling the Switch Stack . . . . .</b>	<b>29</b>
<b>Configuring and Bringing Up a Stack . . . . .</b>	<b>31</b>
<b>Managing a Stack . . . . .</b>	<b>32</b>
Master and Member Switches . . . . .	32
Stack Startup . . . . .	32

6	Next Steps . . . . .	34
7	Technical Specifications . . . . .	35
	<b>Chassis Physical Design</b> . . . . .	<b>35</b>
	<b>Environmental Parameters</b> . . . . .	<b>35</b>
	<b>Power Requirements</b> . . . . .	<b>36</b>
	<b>IEEE Standards</b> . . . . .	<b>36</b>



# Introduction

This document provides basic information about the Dell PowerEdge M I/O Aggregator, including how to install the switch in the Dell PowerEdge M1000e Enclosure and perform the initial configuration.

For more detailed information about any of the basic installation steps, refer to the *Dell PowerEdge M1000e Enclosure Owner's Manual* on the Dell Support website at <http://support.dell.com/manuals>.

## Product Description

The I/O Aggregator is a zero-touch, layer 2 switch blade with two fixed 40GbE ports on the base module and support for two optional plug-in modules. The Aggregator operates in a Dell PowerEdge M1000e chassis, which can support up to 32 servers and six I/O Aggregator blade switches.

The Aggregator runs the Dell Force10 Operating System (FTOS) and auto-configures as an unmanaged switch with bridging and multiplexing functionality, which transmits traffic as follows:

- GbE/10GbE connections through the midplane to up to 32 server ports in the chassis
- 10GbE connections through uplink ports to top-of-rack (ToR) switches
- 40GbE connections through stacking ports to other I/O Aggregators in a switch stack

In a data center network, the Aggregator functions as a flat layer 2 pass-through switch that interoperates with Dell and third-party ToR devices.

The switch supports data center bridging (DCB) features, and provides seamless connectivity for a Fiber Channel over Ethernet (FCoE) server and iSCSI storage data traffic.

In its default operational mode, the Aggregator requires no additional configuration; network connectivity for servers in an M1000e chassis is enabled. By simplifying switch configuration and management, the Aggregator reduces complexity in a data center network.

# Hardware Overview

This section contains information about device characteristics and modular hardware configurations for the Aggregator.

## Internal Ports

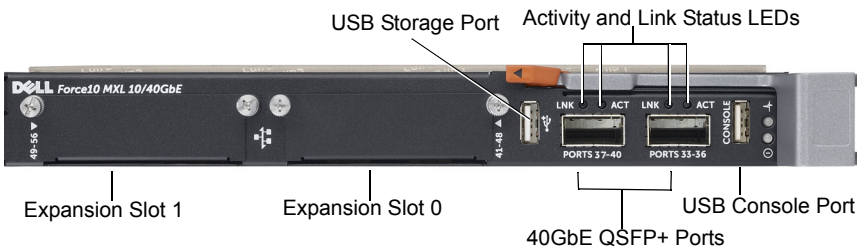
The Aggregator provides thirty-two 1/10-Gigabit Ethernet internal ports. The internal ports are connected to server blades through the M1000e chassis midplane. Each port can operate in either 1GbE or 10GbE mode.

The Aggregator also provides an internal Ethernet interface—the out-of-band (OOB) interface—which is dedicated to switch management. Traffic on this port is segregated from operational network traffic on the switch ports and cannot be switched or routed to the operational network.

## Front Panel

Figure 1-1 shows the Aggregator front panel:

**Figure 1-1. I/O Aggregator Front Panel**



## Base Module with 40GbE Ports

The Aggregator provides two fixed 40-Gigabit Ethernet ports on the base module. By default, these ports operate in 4x10GbE mode with breakout cables and support up to eight 10GbE uplinks. You can also use the base-module ports as 40GbE links for stacking.




## FlexIO™ Modules with Uplink Ports

On the Aggregator, FlexIO plug-in modules (Figure 1-2) operate only as uplinks; stacking is not supported. The following modules are supported in the two expansion slots:

- 4-Port 10-Gigabit Ethernet module using SFP+ optics or direct-attach cables (1m, 3m, or 5m DAC)

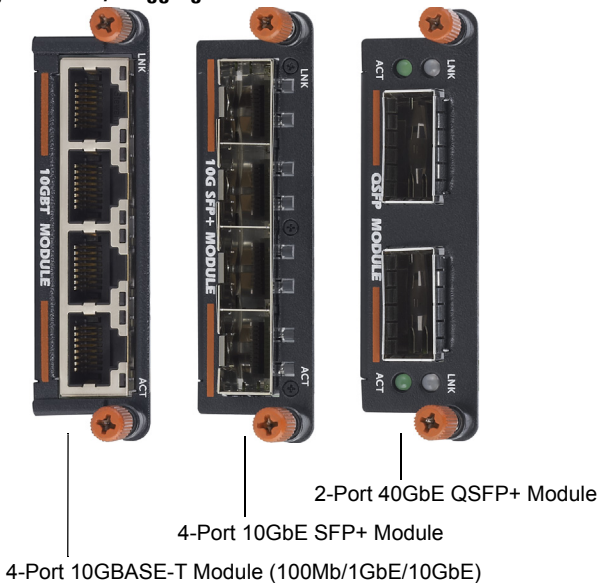
4-Port 10GBASE-T module using RJ-45 connector (copper) cables

 **NOTE:** Only one 4-Port 10GBASE-T module is supported in an Aggregator.

 **NOTE:** The 10M speed is not supported on the 4-Port 10GBASE-T module. Only 100M, 1G, and 10G speeds are supported.

- 2-Port 40-Gigabit Ethernet QSFP+ (SR or direct attach only) module only for 10GbE SFP+ connections using 4x10GbE breakout cables.

**Figure 1-2. I/O Aggregator: FlexIO Modules**



Use the FlexIO modules in an Aggregator that operates in standalone or stacking mode:

- In standalone mode, you can install any of the supported FlexIO modules in two expansion slots. All ports operate at 10GbE to provide increased bandwidth of up to 160Gbps for uplinks. Stacking is not supported.
- In stacking mode, only the 40GbE ports on the base module are used for stacking. FlexIO modules are required for uplink connections.

#### **Usage Notes:**

- After you insert any FlexIO module into an empty slot, you must reload the Aggregator for the module to be operational.
- You can hot swap FlexIO modules of the same type without having to reboot the Aggregator. If you insert a different type of plug-in module, you must reload the Aggregator for the new module to be recognized.
- All uplink ports are in the same 10GbE link aggregation group (LAG).

#### **Tips for Aggregator standalone operation:**

- If you use 16 servers in an M1000e and you want a 2:1 oversubscription, you only need to use the base module ports in 8x10GbE mode.
- If you use 32 servers in an M1000e and you want a 2:1 oversubscription, use the base-module ports in 8x10GbE mode and either a 2-Port 40GbE QSFP+ module operating in 8x10GbE mode or two 4-Port 10GbE SFP+ modules. Use breakout cables with the 2-Port QSFP+ module.

#### **Tips for Aggregator stacking operation:**

- To provide uplink connectivity for the stack, you must use at least one FlexIO module in either expansion slot on any Aggregator in the stack.
- To optimize redundancy and high availability, Dell Force10 recommends that you use at least one FlexIO module for uplinks on each Aggregator in a stack. If you do not use a FlexIO module on each stacked Aggregator for uplink connectivity, in the event of a stack split, the server-facing ports on Aggregators without an uplink connection are brought down.

All FlexIO modules, transceivers, and direct attach cables are sold separately.

# Port Numbering

When installed in a PowerEdge M1000e Enclosure, Aggregator ports are numbered 1 to 56. Ports 1 to 32 are internal server-facing ports. Ports 33 to 56 are external ports numbered from the bottom to the top of the switch as follows:

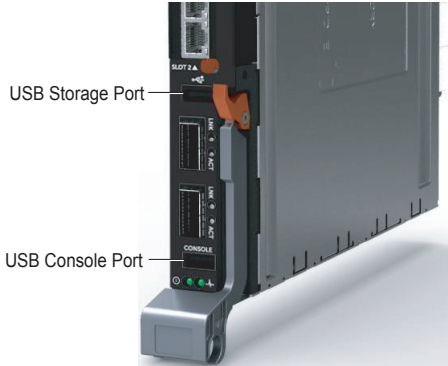
- The 40GbE base-module ports operate:
  - In standalone 4x10GbE mode (default); ports are numbered 33 to 36 and 37 to 40.
  - In stacking mode; ports are numbered 33 and 37, and cannot be used for uplinks.
- The 2-Port 40-GbE QSFP+ module operates only in 4x10GbE mode:
  - In the bottom expansion slot, ports are numbered 41 to 44 and 45 to 48.
  - In the top expansion slot, ports are numbered 49 to 52 and 53 to 56.
- 4-Port 10-GbE SFP+ and 4-Port 10GBASE-T modules operate only in 4x10GbE mode:
  - In the bottom expansion slot, ports are numbered 41 to 44.
  - In the top expansion slot, ports are numbered 49 to 52.

To configure a port, you must specify the slot (0-5; default: 0) and port number (1 to 56) in the **interface** *port-type slot/port* command, where *slot* is the unit number of the Aggregator displayed in the **show system brief** command; for example:

```
FTOS(conf)# interface tengigabitethernet 0/4
```

# USB Console Port

**Figure 1-3. USB Ports on Front Panel**



Use the lower USB console port (Figure 1-3) to manage the switch through an RS-232 serial interface. This port provides a direct connection to the switch and allows you to access the command-line interface (CLI) from a console terminal connected to the port through the provided serial cable (with USB type-A to female DB-9 connectors).

The console port supports asynchronous data of eight data bits, one stop bit, no parity bit, and no flow control. The default baud rate is 9600 bps.

The upper USB port (Figure 1-3) functions as an external flash drive that you can use to store configuration files, scripts, and so on.

# System and Port LEDs

The front panel of the Aggregator contains light emitting diodes (LEDs) that provide information about the status of the switch (Figure 1-4).

**Figure 1-4. System LEDs on Front Panel**

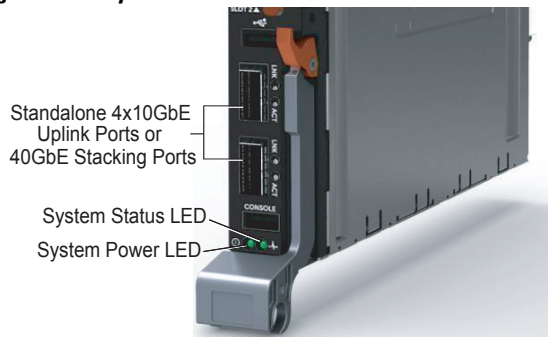


Table 1-1 describes system LED conditions.

**Table 1-1. System LEDs**

System LED	Color	Meaning
Power	Green	Power is being supplied to the switch.
	Off	The switch does not have power.
Status	Blue	The switch is operating normally as a standalone switch or as a stack master.
	Off	The switch is not the stack master.
	Amber	A fault has occurred, or the switch is booting.

Plug-in modules and the base module (Figure 1-1) also contains LEDs that provide information about the link status and traffic activity on a port.

**Figure 1-5. Port LEDs**

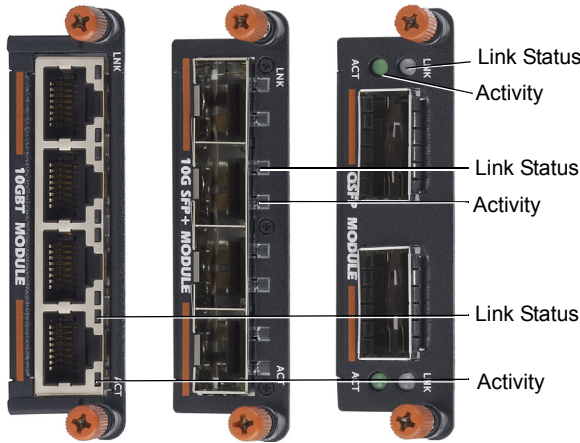


Table 1-2 describes the LED status of 10GbE BASE-T, 10GbE SFP+, and 40GbE QSFP+ ports used in stacking mode on the base module.

**Table 1-2. Port LED Status**

Port LED	Color	Meaning
Link Status	Off	The port is down.
	Green	The port is up and can transmit traffic at maximum speed: A QSFP+ port can transmit at 40G. An SFP+ port can transmit at 10G. A BASE-T port can transmit at 10G.
	Yellow	The port is up and is transmitting traffic at lower than maximum speed: A 40GbE QSFP+ port is transmitting at 10G. A 10GbE SFP+ or 10GbE BASE-T port is transmitting at 1G or 100M.
Activity	Off	No traffic is being transmitted or received on the port.
	Blinking Green	Traffic is being transmitted or received on the port.

Table 1-3 describes the LED status of a 40GbE QSFP+ port that is split into four 10GbE SFP+ ports using a 4x10GbE breakout cable.

Table 1-3. LED Status of 4x10GbE Port

Port LED	Color	Meaning
Link Status	Off	All four 10GbE ports on a breakout cable are down.
	Yellow	At least one of the four 10GbE ports on a breakout cable is up.
Activity	Off	No traffic is being transmitted on any 10GbE port on the breakout cable.
	Blinking	Traffic is being transmitted or received on at least one of the 10GbE ports on the breakout cable.
	Green	

# Installation

## Site Preparation

Before installing the switch or switches, ensure that the chosen installation location meets the following site requirements:

- Clearance — There is adequate front and rear clearance for operator access. Allow clearance for cabling, power connections, and ventilation.
- Cabling — The cabling is routed to avoid sources of electrical noise such as radio transmitters, broadcast amplifiers, power lines, and fluorescent lighting fixtures.
- Ambient Temperature — The ambient switch operating temperature range is 10° to 40°C (50° to 104°F).



**NOTE:** Decrease the maximum temperature by 1°C (1.8°F) per 300 m (985 ft.) above 900 m (2955 ft.).

- Relative Humidity — The operating relative humidity is 8% to 85% (non-condensing) with a maximum humidity gradation of 10% per hour.

# Unpacking the Aggregator

## Package Contents

When unpacking each switch, ensure that the following items are included:

- One PowerEdge M I/O Aggregator switch blade
- One USB type A-to-DB-9 female cable
- *Getting Started Guide*
- *Safety and Regulatory Information*
- *Warranty and Support Information*
- *Software License Agreement*

## Unpacking Steps



**NOTE:** Before unpacking the switch, inspect the container and immediately report any evidence of damage.

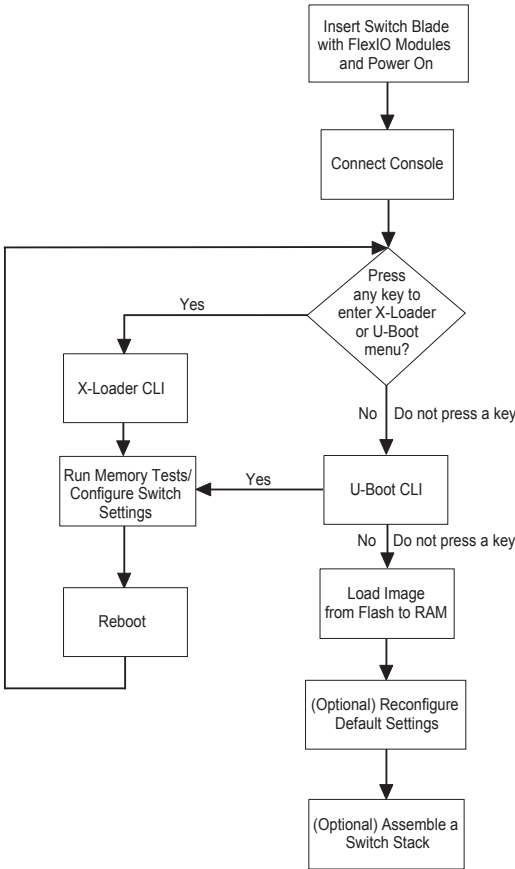
- 1 Place the container on a clean, flat surface and cut all straps securing the container.
- 2 Open the container or remove the container top.
- 3 Carefully remove the switch from the container and place it on a secure and clean surface.
- 4 Remove all packing material.
- 5 Inspect the product and accessories for damage.

# Installing and Configuring the Aggregator

After you unpack the Aggregator, refer to the flow chart in Figure 1-6 for an overview of the steps you must follow to install the blade and perform the initial configuration.




**Figure 1-6. I/O Aggregator: Installation and Configuration Flow Chart**



# Installing the Aggregator in a PowerEdge Chassis

After you unpack the Aggregator, install FlexIO modules in the base module and slide the Aggregator into one of the open I/O module slots in the back of a PowerEdge M1000e chassis.

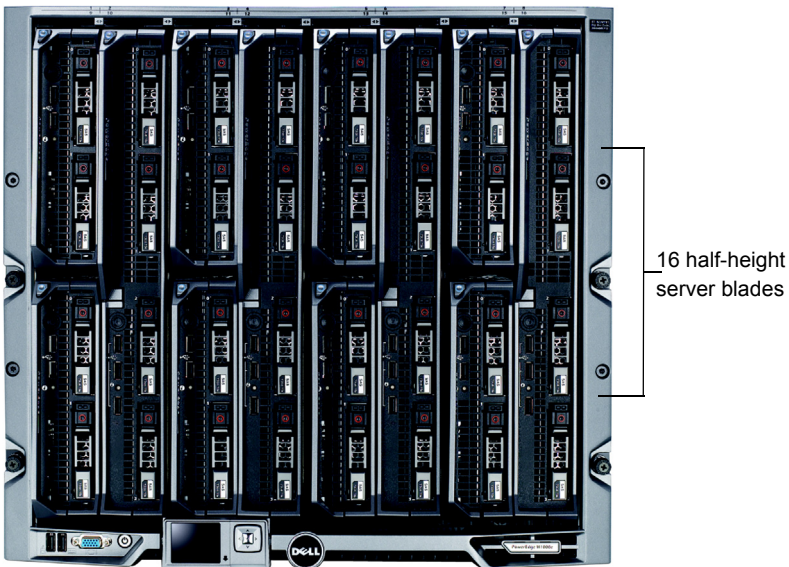
 **NOTE:** If you plug a FlexIO module into an Aggregator that is already powered on and inserted in an M1000e chassis, you must reboot the Aggregator for the plug-in module to be activated.

The M1000e chassis is a 10U rack-mountable blade chassis that holds:

- Server blades: Eight full-height or 16 half-height, or 32 quarter-height blades
- Switch blades: Six I/O modules and two integrated chassis management controllers

Server blades are installed in the front of the chassis (Figure 1-7); I/O modules are installed in the back of the chassis (Figure 1-8).

**Figure 1-7. PowerEdge M1000e: Front View with Server Blades**



**Figure 1-8. PowerEdge M1000e: Back View with Six Aggregator Blades**



After you slide the Aggregator in so that the connectors on the back of the blade are inserted into the chassis midplane, the switch receives power from the chassis and automatically powers on. The chassis management controller (CMC) in the chassis validates that the switch blade is a supported I/O module before powering it on.

When the Aggregator powers on, the Boot loader loads the image in the local flash. The image initializes the hardware and brings the switch up in operational mode.

# Connecting a Console Terminal

After the I/O Aggregator powers on, complete all external cabling connections and connect a terminal to the blade to configure the switch.

To monitor and configure the Aggregator using the serial console, use the USB console port on the front panel of the switch ( Figure 1-3) to connect it to a VT100 terminal or to a computer running VT100 terminal emulation software. The console port is implemented as a data terminal equipment (DTE) connector.

The following equipment is required to use the console port:

- VT100-compatible terminal or a desktop or a portable computer with a serial port running VT100 terminal emulation software, such as Microsoft HyperTerminal.
- A serial cable (provided) with a USB type-A connector for the console port and DB-9 connector for the terminal.

Perform the following tasks to connect a terminal to the switch console port:

- 1** Connect the DB-9 connector on the serial cable to the terminal or computer running VT100 terminal emulation software.
- 2** Configure the terminal emulation software as follows:
  - a** Select the appropriate serial port (for example, COM 1) to connect to the console.
  - b** Set the data rate to 9600 baud.
  - c** Set the data format to 8 data bits, 1 stop bit, and no parity.
  - d** Set the flow control to none.
  - e** Set the terminal emulation mode to VT100.
  - f** Select Terminal keys for Function, Arrow, and Ctrl keys. Ensure that the setting is for Terminal keys (not Microsoft Windows keys).

Connect the USB connector on the cable directly to the switch console port. The console port on the Aggregator is located below the fixed 40GbE ports (Figure 1-3).

## Invoking the X-Loader and U-Boot CLIs

During the boot process, you can perform various configuration tasks by accessing the X-Loader and U-Boot CLIs, such as running memory tests (X-Loader) and activating the backup image or recovering a password (U-Boot).

You are first prompted to enter the X-Loader CLI by pressing any key when the following message is displayed: `Hit any key to stop autoboot.` If you do not press a key, the boot process continues and you are prompted to enter the U-Boot CLI by pressing any key.

After performing any of the X-Loader or U-Boot tasks, the switch automatically reboots when you exit a CLI. To continue with the boot process without entering either CLI, do not press a key.

## Reconfiguring Default Settings

The I/O Aggregator provides zero-touch configuration with:

- default user name (**root**)
- password (**calvin**)
- VLAN (**vlan1**) and IP address for in-band management (**DHCP**)
- IP address for out-of-band (OOB) management (**DHCP**)
- read-only SNMP community name (**public**)
- broadcast storm control (**enabled**)
- IGMP multicast flooding (**enabled**)
- VLAN configuration (all ports belong to all VLANs)

You can change any of these default settings using the CLI. You can change many of the default settings using the CMC interface as described in "Reconfiguration Using the CLI" on page 22.

## Before You Start

Before you reconfigure default settings, ensure that:

- The Aggregator booted successfully when it powered on.
- The console connection is established and the login prompt appears on the screen of a VT100 terminal or terminal equivalent.

By default, the Aggregator receives the following IP addresses from a DHCP server in the network. If you want to change the DHCP default setting, obtain the required information from your network administrator, such as:

- The IP address and subnet mask of the out-of-band interface used for remote management via Telnet, SNMP, or other management agents.
- The IP address and subnet mask of the default VLAN IP address used for in-band management.
- The IP address of the default gateway used for IP access to the Aggregator.

## Reconfiguration Using the CMC Interface

For information about how to access the CMC to configure an Aggregator, refer to the *Dell Chassis Management Controller (CMC) User's Guide* on the Dell Support website at

<http://support.dell.com/support/edocs/systems/pem/en/index.htm>. The CMC online help provides information about how to use the Web interface. The default settings that you can change using the CMC interface are noted in the CLI reconfiguration procedure below.

## Reconfiguration Using the CLI

To reconfigure any settings in the default Aggregator configuration using the CLI:

- 1 (CMC-supported) From the console monitor or a remote management session, log in by entering the user ID "root" and password "calvin". Then press Enter.

```
Login: root
Password: *****
FTOS>
```

- 2 At the EXEC mode prompt, enter **enable**. At the EXEC Privilege prompt, enter **configure** to reach the configuration command mode.

```
FTOS> enable
FTOS# configure
FTOS(conf) #
```

- 3 (CLI only) At the configuration mode prompt, enter the **hostname** *name* command to configure a hostname for the Aggregator, where *name* is a text string of up to 20 alphanumeric characters.

Host names must start with a letter and end with a letter or number. Characters within the string can be letters, numbers, and hyphens.

```
FTOS(conf) # hostname Aggregator1
FTOS(conf) #
```

- 4 (CMC-supported) To reconfigure the default username and password, enter the **username** *name* **password** *password* command, where *name* is a string of up to 63 alphanumeric characters and *password* is a string of up to 32 characters. Both values are case sensitive; spaces are supported.

```
FTOS(conf) # username admin password dellAggl
FTOS(conf) #
```

- 5 (CLI only) At power up, the default VLAN for all ports is VLAN 1. To reconfigure the default VLAN, enter the **default vlan** *vlan-id* command; for example:

```
FTOS(conf) # default vlan 3
```

- 6 (CMC-supported) To reconfigure the SNMP community name used for read-only management access to the switch, enter the **snmp-server community** *name* **ro** command, where *name* is a text string of up to 20 alphanumeric characters and **ro** specifies read-only permission.

```
FTOS(conf) # snmp-server community dellSNMP ro
```

- 7 (CMC-supported) By default, the IP address and subnet mask of the out-of-band management interface used for remote SNMP or Telnet access is assigned by a DHCP server. You can reconfigure the default setting by specifying an IP address with the following commands:

**interface** **ManagementEthernet** *slot/port*, where *slot* is 0-1 and *port* is 0.  
**ip address** *ip-address/mask*, where *ip-address* is in dotted-decimal format (A.B.C.D) and *mask* is a subnet mask in /prefix-length format (/xx).  
**no shutdown** enables the interface.

For example:

```
FTOS (conf) # interface ManagementEthernet 1/0
FTOS (conf-if-ma-1/0) # ip address 128.0.0.1/24
FTOS (conf-if-ma-1/0) # no shutdown
```

- 8** (CMC-supported) To reconfigure the default route used by the out-of-band interface to access the Aggregator from a remote network, enter the **management route subnet/mask managementethernet** command, where *subnet/mask* is an IP address in dotted decimal format (A.B.C.D) and a subnet mask that defines the out-of-band management network.

```
FTOS (conf) # management route 10.0.0.0/24
```

- 9** (CLI only) By default, the IP address of the default VLAN used to access the switch from an in-band routing interface is assigned by a DHCP server. You can reconfigure the default setting by specifying an IP address with the **ip address ip-address/mask** command:

```
FTOS (conf) # interface vlan 1
FTOS (conf-if-vl-1) # ip address 10.1.1.4/24
```

- 10** (CLI only) To reconfigure the default route used by the in-band management interface (default VLAN) used to access the Aggregator from a remote network, enter the **ip route subnet/mask vlan 1** command, where *subnet/mask* is an IP address in dotted decimal format (A.B.C.D) and a subnet mask that defines the in-band management network.

```
FTOS (conf) # ip route 10.1.1.0/24 vlan 1
```

- 11** (CLI only) By default, broadcast storm control is enabled on an Aggregator to limit unregistered unicast, multicast, and broadcast packets. To disable storm control, enter the following command:

```
FTOS (conf) # no io-aggregator broadcast storm-control
```

- 12** (CLI only) By default, IGMP multicast flooding is enabled on an Aggregator. To disable multicast flooding to send unregistered multicast packets only to interested hosts in a VLAN, enter the following command:

```
FTOS (conf) # no ip igmp snooping flood
```



- 13** (CLI only) To verify the reconfigured settings, enter the **show running-config** command.

```
FTOS(conf)# show running-config
```

- 14** (CMC-supported) To save reconfigured settings to the startup configuration, enter the **write memory** command.

```
FTOS(conf)# write memory
```

For more information about Aggregator configuration using the CLI, refer to the *Dell Force10 FTOS Configuration Guide for the PowerEdge M I/O Aggregator*.

## Aggregator Auto-Configuration

After the Aggregator powers on, it auto-configures and is operational with software features enabled, including:

- VLANs: All ports are configured as members of all (4094) VLANs. All VLANs are up and can send or receive layer 2 traffic. For more information, refer to "Configuring VLANs" on page 27.
- Data Center Bridging Capability Exchange Protocol (DCBX)
- Fiber Channel over Ethernet (FCoE) connectivity
- FCoE Initiation Protocol (FIP) snooping
- Hybrid ports: Ports are administratively up and auto-configured to operate as hybrid ports to transmit tagged and untagged VLAN traffic.
- iSCSI optimization
- IGMP snooping
- Jumbo frames: Ports are set to a maximum MTU of 12,000 bytes by default.
- Link aggregation: All uplink ports are configured in a single LAG (LAG 128).
- Link Layer Discovery Protocol (LLDP): Enabled on all ports.
- Link tracking: Enables server-facing links to be brought up only if the uplink port-channel (LAG 128) is up.

## **DCB Support**

DCB enhancements for data center networks are supported to eliminate packet loss and provision links with required bandwidth.

The Aggregator provides zero-touch configuration for DCB. The Aggregator auto-configures DCBX port roles to match the DCBX configuration in the ToR switches to which it connects through its uplink ports.

## **FCoE Connectivity**

Many data centers use Fiber Channel (FC) in storage area networks (SANs). Fiber Channel over Ethernet (FCoE) encapsulates Fiber Channel frames over Ethernet networks.

On an Aggregator, the internal ports support FCoE connectivity and connect to the converged network adapter (CNA) in blade servers. FCoE allows Fiber Channel to use 10-Gigabit Ethernet networks while preserving the Fiber Channel protocol.

The Aggregator also provides zero-touch configuration for FCoE configuration. The Aggregator auto-configures to match the FCoE settings used in the ToR switches to which it connects through its uplink ports.

## **iSCSI Operation**

Support for iSCSI traffic is turned on by default when the Aggregator powers up. No configuration is required.

When the Aggregator powers up, it monitors known TCP ports for iSCSI storage devices on all interfaces. When a session is detected, an entry is created and monitored as long as the session is active.

The Aggregator also detects iSCSI storage devices on all interfaces and auto-configures to optimize performance. Performance optimization operations, such as Jumbo frame size support, STP port-state fast, and disabling of storm control on interfaces connected to an iSCSI storage device, are applied automatically.

CLI configuration is necessary only when the configuration includes iSCSI storage devices that cannot be automatically detected and when non-default QoS handling is required.

## Link Aggregation

All uplink ports are configured in a single LAG (LAG 128). Server-facing ports are auto-configured as part of link aggregation groups if the corresponding server is configured for LACP-based NIC teaming. Static LAGs are not supported.

**Tip:** The recommended LACP timeout is long-timeout mode.

## Link Tracking

By default, all server-facing ports are tracked by the operational status of the uplink LAG. If the uplink LAG goes down, the Aggregator loses its connectivity and is no longer operational; all server-facing ports are brought down.

**Tip:** If installed servers do not have connectivity to a ToR switch, check the Link Status LED of uplink ports on the Aggregator. If all LEDs are on, check the LACP configuration on the ToR switch that is connected to the Aggregator to ensure the LACP is correctly configured.

## Configuring VLANs

By default, all Aggregator ports belong to all 4094 VLANs and are members of untagged VLAN 1. You can use the CLI or CMC interface to configure only the required VLANs on a port.

When you configure VLANs on server-facing interfaces (ports 1 to 32), you can assign VLANs to a port or a range of ports by entering the **vlan tagged** or **vlan untagged** commands in interface configuration mode; for example:

```
FTOS(conf)# interface tengigabitethernet 0/2 - 4
FTOS(conf-if-range-te-0/2-4)# vlan tagged 5,7,10-12
FTOS(conf-if-range-te-0/2-4)# vlan untagged 3
```

You can also use the CMC interface to configure VLANs. For information about how to access the CMC, refer to the *Dell PowerEdge M1000e Enclosure Hardware Owner's Manual* or *Dell Chassis Management Controller (CMC) User's Guide* on the Dell Support website at <http://support.dell.com/support/edocs/systems/pem/en/index.htm> The CMC online help provides information about how to use the Web interface.

## Uplink LAG

The tagged VLAN membership of the uplink LAG is automatically configured based on the VLAN configuration of all server-facing ports (ports 1 to 32).

The untagged VLAN used for the uplink LAG is always the default VLAN.

## Server-Facing LAGs

The tagged VLAN membership of a server-facing LAG is automatically configured based on the server-facing ports that are members of the LAG.

The untagged VLAN of a server-facing LAG is configured based on the untagged VLAN to which the lowest numbered server-facing port in the LAG belongs.

**Tip:** Dell Force10 recommends that you configure the same VLAN membership on all LAG member ports.

## Stacking Mode

When you configure an Aggregator to operate in stacking mode ("Configuring and Bringing Up a Stack" on page 31), VLANs are reconfigured as follows:

- If an Aggregator port belonged to all 4094 VLANs in standalone mode (default), all VLAN membership is removed and the port is assigned only to default VLAN 1. You must configure additional VLAN membership as necessary.
- If you had manually configured an Aggregator port to belong to one or more VLANs (non-default) in standalone mode, the VLAN configuration is retained in stacking mode only on the master switch.

When you reconfigure an Aggregator from stacking to standalone mode:

- Aggregator ports that you manually configured for VLAN membership in stacking mode retain their VLAN configuration in standalone mode.
- To restore the default auto-VLAN mode of operation (in which all ports are members of all 4094 VLANs) on a port, enter the **auto vlan** command; for example:

```
FTOS(conf)# interface tengigabitethernet 0/2
FTOS(conf-if-te-0/2)# auto vlan
```

# Assembling a Switch Stack

After you complete the initial configuration, the Aggregator is powered up and operational. Stacking is supported only on the 40GbE ports on the base module.

Stacking is limited to two Aggregators in the same chassis in a single stack. Up to three stacks are supported in an M1000e chassis. To configure a switch stack, you must use the CLI.

## Cabling the Switch Stack

Figure 1-9 shows a stacking example using two Aggregators in a chassis. The Aggregators are connected to operate as a single stack in a ring topology using only the 40GbE ports on the base modules. You can use the 40GbE ports on the base module to create a stack in either a ring or daisy-chain topology.

**Prerequisite:** Before you attach the stacking cables, all Aggregators in the stack must be powered up with the default or reconfigured settings as described in "Reconfiguring Default Settings" on page 21.

**Figure 1-9. Switch Stack Using 40GbE Ports on Two Aggregators**



Use only QSFP transceivers and QSFP cables (separately purchased) to connect stacking ports; for example:

- 1 Insert a QSFP cable in the bottom base-module port on the rightmost Aggregator.
- 2 Connect the cable to the bottom base-module port on the next Aggregator to the left.
- 3 On the leftmost Aggregator, connect the top base-module port to the top base-module port on the rightmost Aggregator to create a loop.



**NOTE:** The resulting topology allows the stack to function as a single switch with resilient fail-over capabilities.

## Configuring and Bringing Up a Stack

After you attach the cables in a stack of Aggregators, follow these steps to configure and bring up the stack:

- 1 Connect the terminal to the console port on an Aggregator. Enter the following commands to access the CLI and configure the base-module ports for stacking mode:

```
Login: username
Password: *****
FTOS> enable
FTOS# configure
FTOS(conf)# stack-unit 0 iom-mode stack
```

Where **stack-unit 0** defines the default stack-unit number in the initial configuration of a switch.

- 2 Save the stacking configuration on the 40GbE ports:  

```
FTOS# write memory
```
- 3 Repeat Steps 1 and 2 on each Aggregator in the stack by entering the **stack-unit 0 iom-mode stack** command and saving the configuration.
- 4 Reboot each Aggregator by entering the reload command in EXEC Privilege mode:

```
FTOS# reload
```

If the stacked switches all reboot at approximately the same time, the Aggregator with the highest MAC address is automatically elected as the master switch. The Aggregator with the next highest MAC address is elected as standby master.

**Tip:** You can ensure that a stacked switch becomes the master by rebooting the switch first, and waiting for it to come up before rebooting the second switch in the stack.

The Status LED on the Aggregator that is elected as the master switch is blue. Perform VLAN and other software configuration for the stack by connecting to the console port on the master unit.

To determine which switch is the stack master, you can also enter the **show system** command at the terminal.

To remove an Aggregator from the stack, enter the **stack-unit 0 iom-mode standalone** command in global configuration mode. After entering the command, save the configuration and reload the Aggregator for the change to take effect.

## Managing a Stack

### Master and Member Switches

You can manage a stack of Aggregators as a single entity when they are connected together. Manage the stack from the CLI through the serial console connection or a remote Telnet session over the OOB management IP address.

When a stack is created, one switch automatically becomes the master switch and another switch is elected standby master. The master switch maintains stack operation with minimal impact in the event of:

- Switch failure
- Inter-switch stacking link failure
- Switch insertion
- Switch removal

If the master switch goes off line, the standby master replaces it as the new master.

### Stack Startup

#### Topology Discovery

When a stack is formed, a topology discovery process builds up a database that contains information about both switches in the stack, including the FTOS version, hardware version, management priority, and switch MAC address. Use the CLI (**show system** command) to view this information.

#### Auto Stack Number Assignment

During the stack formation process, a unique stack-unit number is assigned if the same number is assigned to more than one switch. After assignment is complete, each switch saves its stack-unit number. To view stack-unit numbers, enter the **show system** command.



## FTOS Version Checking

Following the stack-unit number assignment, the master switch performs a consistency check to ensure both switches in the stack are running the same FTOS version.

If the master switch determines that both switches are not running the same FTOS version, the ports on the non-master switch with the incorrect version are disabled.

To download the required FTOS image from the master switch and reload a member switch so that it joins the stack, enter the following command in EXEC Privilege mode:

```
FTOS# upgrade system stack-unit unit-number partition
```

Where **stack-unit** *unit-number* identifies the switch whose FTOS version needs to be upgraded; *partition* identifies the partition on the master switch from which the FTOS image boots up. For example:

```
FTOS# upgrade system stack-unit 3 a:
```

To display the boot partition used on the master switch, enter the **show version** command.

To ensure that a stack unit boots from partition a:, enter the commands:

```
FTOS# configure
FTOS(conf)# boot system stack-unit unit-number primary system
a:
FTOS(conf)# end
FTOS# write memory
FTOS# power-cycle stack-unit unit-number
```



**NOTE:** When an Aggregator is stacked, booting is supported only from flash memory; it is not supported over the network using an IP address.

## System Initialization

The master switch initializes the stack using the last saved system configuration file.

If you change the stack configuration, be sure to save the configuration file. The master switch automatically distributes the configuration file to the standby master switch.

In case of a split stack in which the master switch and standby master become disconnected, the last saved configuration is used on both switches. The two switches now operate as two separate stacks, each consisting of one switch.

# Next Steps

- You can customize the Aggregator for use in your data center network as necessary. To perform additional switch configuration, do one of the following:
  - For remote out-of-band management, enter the OOB management interface IP address into a Telnet or SSH client and log in to the switch using the user ID and password to access the CLI.
  - For local management using the CLI, use the attached console connection.
  - For remote in-band management from a network management station, enter the VLAN IP address of the management port and log in to the switch to access the CLI.
- If you installed the Aggregator in a stack, you can configure additional settings for switch stacking.
- In case of an FTOS upgrade, you can check to see that an Aggregator is running the latest FTOS version by entering the **show version** command. To download an FTOS version, go to <http://support.dell.com>.

For information about how to configure software features, refer to the *User's Configuration Guide for the PowerEdge M I/O Aggregator* on the Dell Support website at <http://support.dell.com/manuals>.

# Technical Specifications

The Aggregator is an I/O module and installed with the Server (model: PowerEdge M1000e) for communication.

 **CAUTION: Lithium Battery Caution: There is a danger of explosion if the battery is incorrectly replaced.**

Replace batteries only with same or equivalent type. Dispose of the batteries according to the manufacturer's instructions.

## Chassis Physical Design

Parameter	Specifications
Height	1.32 inches (33.45 mm)
Width	10.81 inches (274.75 mm)
Depth	12.17 inches (309.24 mm)

## Environmental Parameters

Parameter	Specifications
Operating temperature	32° to 104°F (0° to 40°C)
Operating humidity	10 to 85% (RH), non-condensing
Storage temperature	−40° to 158°F (−40° to 70°C)
Storage humidity	5 to 95% (RH), non-condensing
Maximum thermal output	419.7 BTU/hr

# Power Requirements

Parameter	Specifications
Power supply	100–240 VAC 50/60 Hz
Maximum current draw per system	2 A @ 100/120 VAC 1 A @ 200/40 VAC
Maximum power consumption	123 Watts
Reliability	MTBF 355,178 hours

# IEEE Standards

The Aggregator complies with the following IEEE standards:

- 802.1AB LLDP
- 802.1p L2 Prioritization
- 802.1Q VLAN Tagging
- 802.3ab Gigabit Ethernet (1000BASE-T)
- 802.3ac Frame Extensions for VLAN Tagging
- 802.3ad Link Aggregation with LACP
- 802.3ae 10 Gigabit Ethernet (10GBASE-X)
- 802.3ap 10GbE-KR
- 802.3u Fast Ethernet (100BASE-TX)
- 802.3x Flow Control
- 802.3z Gigabit Ethernet (1000BASE-X)
- MTU 12K bytes





Printed in the U.S.A.

[www.dell.com](http://www.dell.com) | [support.dell.com](http://support.dell.com)



0KGCK9A00